

Remarks

This Application has been carefully reviewed in light of the Office Action mailed February 8, 2005. Applicant appreciates the Examiner's consideration of the Application. Applicant has made clarifying amendments to independent Claim 21. At least certain of these amendments are not considered narrowing, and none are considered necessary for patentability. Applicant respectfully requests reconsideration and allowance of all pending claims.

I. The Claim Objections should be Withdrawn

The Examiner objects to Claims 21-30 due to alleged informalities. Particularly, the Examiner contends that "the broadcast range," as recited in Claim 21, appears to have no antecedent basis, "since no particular inherent limit exists as to the range of transmission of the query." (*See* Office Action, Page 2) Although Applicant does not necessarily agree that any objection to Claim 21 is appropriate, Applicant has amended Claim 21 to recite, prior to its recitation of "the broadcast range," "the transmission of the enumeration query having a broadcast range." For at least these reasons, Applicant respectfully requests the Examiner to withdraw the objections to Claim 21 and its dependent claims.

II. Claims 21-30 Recite Patentable Subject Matter

The Examiner rejects Claims 21-30 under 35 U.S.C. § 101 as being directed to non-statutory subject matter.

Amended independent Claim 21, which Applicant discusses as an example, is directed to a "set of logic encoded in media for assisting in inventory assessment, the logic when executed operable to" perform the limitations recited in the body of Claim 21. Applicant respectfully submits that the Examiner improperly rejects Claim 21 and its dependent claims as being directed to non-statutory subject matter.

The Examiner states:

Claims 21-30 are drawn merely to the production and/or manipulation of non-functional descriptive material, therefore effecting no 'useful, concrete, and tangible

result.' Note that claims 21-30 read, for example, merely on a pictorial/graphic image of a flowchart, or, on a written/textual description of an algorithm, either of which document being printed on a sheet of paper media.

(Office Action, Page 3) Applicant respectfully disagrees with the Examiner's position.

Applicant respectfully submits that Claim 21 is not directed to production and/or manipulation of non-functional descriptive material. Non-functional descriptive material is "[d]escriptive material that cannot exhibit any functional interrelationship with the way in which computing processes are performed" M.P.E.P. § 2106.IV.B(1)(b). Examples of such non-functional descriptive material, as stated in the M.P.E.P., include music, literature, art, photographs, and mere arrangements or compilations of facts or data that are merely stored so as to be read or outputted by a computer without creating any functional interrelationship, either as part of the stored data or as part of the computing processes performed by the computer. *Id.* Independent Claim 21, for example, clearly does not qualify as non-functional descriptive material.

Moreover, Applicant respectfully submits that the Office Action's reliance on *In re Lowry* is misplaced.¹ The question of patentable subject matter was not even before the Federal Circuit in that case. *See generally, In re Lowry*, 32 F.3d 1579, 32 U.S.P.Q.2d 1031 (Fed. Cir. 1994).² Instead, *In re Lowry* dealt with "printed matter rejections" made under 35 U.S.C. § 103. *See Lowry*, 32 F.3d at 1582-83, 32 U.S.P.Q.2d at 1034. Thus, this decision has no bearing on the rejections under 35 U.S.C. § 101. To the extent that *In re Lowry* does mention patentable subject matter, the Federal Circuit notes that the Board of Patent Appeals and Interferences actually *reversed* an Examiner's rejection of the relevant claims under 35 U.S.C. § 101, noting that the claims recited an article of manufacture that was statutory. *See id.* at 1582, 1032. Therefore, *In re Lowry* does not support the proposition for which it was cited.

¹ The Office Action states, "It has been held that such claims, even if the non-functional descriptive material is claimed in combination with a computer-readable medium (which claims 21-30 are not), are considered to comprise non-statutory subject matter, for merely manipulating an abstract idea," citing *In re Lowry* as purportedly supporting this statement. (Office Action, Page 3)

² Applicant encloses a copy of *In re Lowry* for the Examiner's convenience.

Furthermore, independent Claim 21 recites a useful, concrete, and tangible result. The patent laws define patentable subject matter as "any new and useful process, machine, manufacture or composition of matter, or any new and useful improvement thereto." See 35 U.S.C. § 101. When an abstract idea is reduced to a practical application, the abstract idea no longer stands alone if the practical application of the abstract idea produces a useful, concrete, and tangible result. This then satisfies the requirements of 35 U.S.C. § 101. See *In re Alappat*, 33 F.3d 1526, 1544, 31 U.S.P.Q.2d 1545, 1557 (Fed. Cir. 1994); see also *State Street Bank & Trust Co. v. Signature Financial Group, Inc.*, 149 F.3d 1368, 1373, 47 U.S.P.Q.2d 1596, 1601-02 (Fed. Cir. 1998). While an abstract idea by itself may not satisfy the requirements of 35 U.S.C. § 101, an abstract idea when practically applied to produce a useful, concrete, and tangible result satisfies 35 U.S.C. § 101. See *AT&T Corp. v. Excel Comm. Inc.*, 172 F.3d 1352, 1357, 50 U.S.P.Q. 1447, 1452 (Fed. Cir. 1999) (stating that as technology progressed, the CCPA overturned some of the earlier limiting principles regarding 35 U.S.C. § 101 and announced more expansive principles formulated with computer technology in mind); see also *In re Musgrave*, 431 F.2d 882, 167 U.S.P.Q. 280 (CCPA 1970) (cited by the Federal Circuit in *AT&T Corp.*, 172 F.3d at 1356). Thus, producing a useful, concrete, and tangible result is the key to patentability according to *State Street* and other applicable case law.

"Only when the claim is devoid of any limitation to a practical application in the technological arts should it be rejected under 35 U.S.C. 101." M.P.E.P. § 2106. Indeed, a method or process remains statutory even if some or all of the steps therein can be performed in the human mind, with the aid of the human mind, or because it may be necessary for one performing the method or process to think. See *In re Musgrave*, 431 F.2d at 893, 167 U.S.P.Q. at 289. As stated by the Federal Circuit in *State Street* and as explicitly confirmed in the M.P.E.P., "[T]ransformation of data, representing discrete dollar amounts, by a machine through a series of mathematical calculations into a final share price, constitutes a practical application of a mathematical algorithm, formula, or calculation, because it produces 'a useful, concrete, and tangible result' -- a final share price momentarily fixed for

recording and reporting purposes and even accepted and relied upon by regulatory authorities and in subsequent trades.” *State Street*, 149 F.3d at 1373, 47 U.S.P.Q.2d at 1601-02; M.P.E.P. § 2106. As discussed below, Applicant’s claims clearly recite a useful, concrete, and tangible result and are therefore directed to patentable subject matter.

The logic recorded in media that is recited in amended Claim 21 is, when executed, operable to:

- generate an enumeration query;
- facilitate transmission of the enumeration query, the transmission of the enumeration query having a broadcast range; and
- monitor messages associated with the enumeration query, wherein at least one of the messages may include data regarding an inventory object beyond the broadcast range of the transmission.

Thus, monitoring messages associated with the enumeration query [wherein at least one of the messages may include data regarding an inventory object beyond the broadcast range of the transmission] is one practical application of independent Claim 21, an example useful, concrete, and tangible result being the monitored messages associated with the enumeration query [wherein at least one of the messages may include data regarding an inventory object beyond the broadcast range of the transmission], for assisting in inventory assessment.

In any event, although Applicant believes Claims 21-30 are directed to patentable subject matter without amendment for the reasons set forth above, Applicant has amended independent Claim 21 to further clarify that Claim 21 is directed to a “set of logic encoded in media” that is “when executed operable to” perform the limitations recited in the body of the claim and is directed to patentable subject matter. None of these amendments are considered narrowing or necessary for patentability.

For at least these reasons, Applicant respectfully requests reconsideration and allowance of independent Claim 21 and its dependent claims.

III. The Claim are Allowable over the Rejections under 35 U.S.C. § 102

The Examiner rejects Claims 21-30 under 35 U.S.C. § 102(a) “as being anticipated by the admitted prior art, as described in the background of the invention on page 2 of the specification [the “*Background*”].” (Office Action, Page 4) Applicant respectfully disagrees and discusses independent Claim 21 as an example.

A. The Examiner did not Consider All Limitations Recited in Claim 21

After objecting to “the broadcast range” in Claim 21 as purportedly lacking antecedent basis, the Examiner stated, “Therefore, for purposes of further consideration of the claims hereinbelow, the limitation will be disregarded.” (Office Action, Page 2) Applicant respectfully submits that the Examiner’s failure to consider this limitation was improper and results in inefficient prosecution.

First, the M.P.E.P., in a section related to prior art rejections of claims that are also rejected as being indefinite, states that “[a]ll words in a claim must be considered in judging the patentability of a claim against the prior art.” M.P.E.P. § 2173.06 citing *In re Wilson*, 424 F.2d 1382, 165 U.S.P.Q. 494 (C.C.P.A. 1970) (emphasis added). This is true even when a claim has been rejected as being indefinite. “The fact that terms may be indefinite [e.g., lack antecedent basis] does not make the claim obvious over the prior art.” M.P.E.P. § 2173.06. The Examiner acknowledged that all words in Claim 21 were not considered “in judging the patentability of [Claim 21] against the [alleged] prior art.” Applicant respectfully submits that this was improper.

Second, “[p]iecemeal examination should be avoided as much as possible.” M.P.E.P. 707.07(g); *see also* M.P.E.P. § 2173.06. Applicant respectfully submits that the Examiner’s failure to consider each and every limitation recited in Applicant’s claims with respect to the art rejections has resulted in piecemeal examination. Based on Attorney for Applicant’s experience, antecedent basis rejections/objections are usually easily overcome by an applicant, “as they are typically drafting oversights that are easily corrected once they are brought to the attention of [the] applicant,” M.P.E.P. § 2173.05(e), and should not serve as a

basis for ignoring limitations recited in an applicant's claims. Such a practice results in piecemeal examination by delaying rejections that could have been made (or consideration of limitations that could have been considered) in a first Office Action until a later Office Action. This is particularly true, as is the case here, when the limitations ignored by the Examiner are clearly not disclosed, taught, or suggested by the alleged prior art on which the Examiner relies.

Thus, Applicant respectfully requests that because the Examiner admittedly did not consider certain limitations when examining Applicant's claims with respect to the art rejections, if the Examiner does not issue a Notice of Allowance in response to this submission, the Examiner issue a new non-final Office Action in which the Examiner considers each and every limitation recited in Applicant's claims.

B. The *Background* Fails to Disclose, Teach, or Suggest Various Limitations Recited in Claim 21

The *Background* fails to disclose, teach, or suggest various limitations recited in Claim 21.

The *Background* discloses that businesses require accurate assessments of their inventory for a variety of reasons," and provides several example reasons. (*Background*, Specification, 2:2-8) According to the *Background*:

Typical systems and methods for assessing inventory involve substantial human interaction. For example, if a business wants to know how many items it has in its inventory, it may have someone count them. As another example, the business may have an employee make a log, in either manual or computerized form, of items as they arrive and depart. Thus, an employee may consult the log to determine the number of items in the inventory. Furthermore, the log may direct the employee to an item.

(*Background*, Specification, 2:9-15) The *Background* then identifies several problems with systems and methods that have "substantial human interaction." (*Background*, Specification, 2:16-23) Therefore, the discussion in the *Background* is clearly limited to systems and methods for inventory assessment that involve substantial human interaction. In fact, the

only examples discussed in the *Background* involve a human manually logging items as they arrive and depart, and manually reviewing a log to determine a number of items in inventory (or to be directed to an item).

In contrast, amended Claim 21³ recites:

A set of logic encoded in media for assisting in inventory assessment, the logic when executed operable to:
generate an enumeration query;
facilitate transmission of the enumeration query, the transmission of the enumeration query having a broadcast range; and
monitor messages associated with the enumeration query, wherein at least one of the messages may include data regarding an inventory object beyond the broadcast range of the transmission.

The manual systems and methods discussed in the *Background* do not disclose, teach, or suggest these limitations. For example, the manual systems and methods discussed in the *Background* do not disclose, teach, or suggest logic encoded in media that, when executed, is operable to “generate an enumeration query,” as recited in Claim 1. As another example, the manual systems and methods discussed in the *Background* do not disclose, teach, or suggest logic encoded in media that, when executed, is operable to “facilitate transmission of the enumeration query, the transmission of the enumeration query having a broadcast range,” as recited in Claim 21. In fact, there is no mention in the *Background* of transmission of enumeration queries. As yet another example, the manual systems and methods discussed in the *Background* do not disclose, teach, or suggest logic encoded in media that, when executed, is operable to “monitor messages associated with the enumeration query, wherein at least one of the messages may include data regarding an inventory object beyond the broadcast range of the transmission,” as recited in Claim 21. There is simply no mention of “monitor[ing] messages associated with [an] enumeration query,” let alone “wherein at least

³ The amendments to Claim 21 were not made in relation to the rejections under 35 U.S.C. § 102 and are not considered necessary to overcome the rejections under 35 U.S.C. § 102. Thus, Applicant respectfully submits that it would be improper for the Examiner to issue a Final Office Action in response to this submission, particularly if the Examiner relies on a new reference in rejecting Applicant's claims in a next Office Action and in light of the fact that the Examiner admittedly did not consider certain limitations recited in Claim 21.

one of the messages may include data regarding an inventory object beyond the broadcast range of the transmission," as recited in Claim 21.

For at least these reasons, Applicant respectfully requests reconsideration and allowance of Claim 21 and its dependent claims.

IV. No Waiver

All of Applicant's arguments and amendments are without prejudice or disclaimer. Additionally, Applicant has merely discussed example distinctions from the rejections made by the Examiner. Other distinctions may exist, and Applicant reserves the right to discuss these additional distinctions in a later Response or on Appeal, if appropriate. By not responding to additional statements made by the Examiner, Applicant does not acquiesce to the Examiner's additional statements. The example distinctions discussed by Applicant are sufficient to overcome the Examiner's rejections.

Conclusion

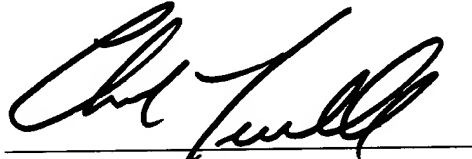
Applicant has made an earnest attempt to place this case in condition for immediate allowance. For at least the foregoing reasons, Applicant respectfully requests allowance of all pending claims.

If the Examiner feels that prosecution of the present Application may be advanced in any way by a telephone conference, the Examiner is invited to contact the undersigned attorney at 214.953.6813.

Although Applicant believes no fees are due, the Commissioner is hereby authorized to charge any deficiency or credit any overpayment to Deposit Account No. 05-0765 of Electronic Data Systems Corporation.

Respectfully submitted,

BAKER BOTTS L.L.P.
Attorneys for Applicant

A handwritten signature in black ink, appearing to read 'Chad D. Terrell', is written over a horizontal line.

Chad D. Terrell
Reg. No. 52,279

Date: May 9, 2005

Customer Number: **35005**

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United States Court of Appeals,
Federal Circuit.
In re Edward S. LOWRY (Serial No. 07/181,105).
No. 93-1558.

Aug. 26, 1994.
Rehearing Denied; Suggestion for Rehearing In
Banc Declined Dec. 19, 1994.

Inventor of computer memory storage system appealed the rejection of claims in patent application by Patent and Trademark Office Board of Patent Appeals and Interferences. The Court of Appeals, Rader, Circuit Judge, held that: (1) claims disclosed were not analogous to printed matter, and (2) claims were not disclosed, anticipated, or made obvious by prior art.

Reversed.

West Headnotes

[1] Patents ↪324.5

291k324.5 Most Cited Cases

Court of Appeals for the Federal Circuit reviews de novo the determinations of obviousness made by the United States Patent and Trademark Office Board of Patent Appeals and Interferences; but reviews factual findings underlying obviousness determination for clear error.

[2] Patents ↪324.55(2)

291k324.55(2) Most Cited Cases

Determination made by United States Patent and Trademark Office Board of Patent Appeals and Interferences, as to whether prior art reference anticipates claimed invention, is question of fact reviewed under clearly erroneous standard by Court of Appeals for the Federal Circuit.

[3] Patents ↪101(3)

291k101(3) Most Cited Cases

Patent and Trademark Office (PTO) must consider all claim limitations when determining patentability of invention over prior art, and PTO may not disregard claim limitations comprised of printed matter.

[4] Patents ↪5

291k5 Most Cited Cases

Claims for computer memory data structure comprising a plurality of attribute data objects were not analogous to unpatentable printed matter, where inventor's claims did not claim merely the information content of memory or underlying data in database, but claims dictated how application programs manage information, defined functional characteristics of the computer memory, and required specific electronic structural elements which imparted physical organization on information stored in memory, and where data structures claimed were specific electrical or magnetic structural elements in a memory. 35 U.S.C.A. §§ 102, 103.

[5] Patents ↪32

291k32 Most Cited Cases

As part of its burden to establish prima facie case of obviousness, burden of establishing absence of novel, nonobvious functional relationship rests with Patent and Trademark Office.

[6] Patents ↪16.14

291k16.14 Most Cited Cases

[6] Patents ↪50.1

291k50.1 Most Cited Cases

[6] Patents ↪77

291k77 Most Cited Cases

Claims for computer memory data structure comprising a plurality of attribute data objects were not obvious, anticipated, or disclosed by prior art, even though prior art disclosed database management system containing an active data

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dictionary that user could access and modify, where claims described new and nonobvious functional relationship of data in computer memory, dictating how application programs manage information, consisting of an organization of information made up of attribute data objects stored in memory, in hierarchical correlation with other attribute data objects in pyramidal structure, combining both functionally and structurally expressive characteristics. 35 U.S.C.A. § 102.

Patents ⇐328(2)

291k328(2) Most Cited Cases
4,774,661. Cited as prior art.

Patents ⇐328(2)

291k328(2) Most Cited Cases
4,774,661. Cited as prior.

*1580 Barry N. Young, Digital Equip. Corp., of Maynard, MA, argued for appellant. With him on the brief was Denis G. Maloney.

Lee E. Barrett, Associate Sol., Office of the Sol., of Arlington, VA, argued for appellee. With him on the brief were Fred E. McKelvey, Sol. and Murriel E. Crawford, Associate Sol.

Before RICH, Circuit Judge, SKELTON, Senior Circuit Judge, and RADER, Circuit Judge.

RADER, Circuit Judge.

Edward S. Lowry appeals the U.S. Patent and Trademark Office Board of Patent Appeals and Interferences' rejection of all claims in Patent Application Serial No. 07/181,105. On July 30, 1993, the Board reversed the rejection of claims 1 through 5 under 35 U.S.C. § 101 (1988). The Board also affirmed the rejection of claims 1 through 19 under 35 U.S.C. § 103 (1988) and claims 20 through 29 under 35 U.S.C. § 102(e) (1988). This court reverses.

BACKGROUND

Lowry's patent application--"Data Processing System Having a Data Structure with a Single, Simple Primitive"--relates to the storage, use, and management of information residing in a memory.

The PTO does not dispute the features and advantages of Lowry's claimed invention. The invention provides an efficient, flexible method of organizing stored data in a computer memory.

A memory stores data according to a particular order or arrangement. Application programs use stored data to perform specified functions. A data model provides the framework for organizing and representing information used by an application program. Data models define permissible data structures-- organizational structures imposed upon the data used by the application program--compatible with particular data processing systems. Data structures are the physical implementation of a data model's organization of the data. Data structures are often shared by more than one application program.

The prior art contains data models and data structures. Prior art data models are generally one of two kinds: functionally expressive or structurally expressive data models. Functionally expressive data models enable complex nested operations using large blocks of data. These data models, however, are limited to a narrow class of applications and generally require more complex interfaces to functionality. Structurally expressive data models, on the other hand, define more varied data structures capable of representing accurately complex information. These data models, however, make complex nested operations on large blocks of data quite difficult.

Lowry's invention seeks to optimize both structural and functional expressiveness. Lowry discloses a data structure accessible by many different application programs. Lowry's data structure is based upon the "Attributive data model." The Attributive data model represents complex information in terms of attributes and relationships between attributes. According to Lowry's specification, "[a]n attribute expresses the idea that one thing is attributed to another thing." Thus, the Attributive data model capitalizes on the concept that a database is a collection of attributions, whereby information is represented in terms of its characteristics and relationships to other

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information.

In accordance with the Attributive data model, Lowry's data structure comprises a plurality of attribute data objects (ADOs) stored in memory. An ADO is a single primitive data element "compris[ing] sequences of bits which are stored in the memory *1581 as electrical (or magnetic) signals that represent information." It contains information used by the application program and information regarding its relationship with other ADOs. Lowry asserts that his data structure is functionally expressive by virtue of its representation of information in terms of attributes. Lowry also states that "[s]tructural expressiveness is achieved by making that primitive data object extremely simple and allowing for highly unconstrained interconnections between attribute instances."

According to the claimed invention, ADOs have both hierarchical and non-hierarchical interrelationships. A few specific rules govern these relationships. Because the claimed invention uses single ADOs governed by simple organizational rules, Lowry asserts that it may flexibly and accurately represent complex objects and relationships. The hierarchical relationships form a conceptual pyramidal structure. Hierarchical correlations describe "holding" or "being held" relationships. An ADO can "hold" one or more other ADOs. Each ADO, however, can "be held" by only one other ADO. Thus, while capable of holding many others, an ADO can be held by only one other ADO. One ADO, called the apex ADO, holds at least one other ADO but is held by no other ADO. This apex ADO is the only ADO that lacks a being-held relationship. From the apex ADO, the hierarchical relationships fan out in a pyramidal structure.

ADOs also have non-hierarchical relationships. These are essentially "pointing" relationships between ADOs. There are two basic types of ADOs: (1) element data objects, which refer to only themselves, and (2) relation data objects, which refer to one other ADO, called a referent ADO. A referent ADO is merely an ADO that a relation data

object refers to. Each ADO can be a referent ADO for more than one ADO. According to Lowry's specification, this arrangement of hierarchically and non-hierarchically related single primitive ADOs facilitates software operations such as retrieval, addition, and removal of information in the data structure.

Claims 1 through 5 claim a memory containing a stored data structure. Claim 1 is representative:

1. A memory for storing data for access by an application program being executed on a data processing system, comprising:
 - a data structure stored in said memory, said data structure including information resident in a database used by said application program and including:
 - a plurality of attribute data objects stored in said memory, each of said attribute data objects containing different information from said database;
 - a single holder attribute data object for each of said attribute data objects, each of said holder attribute data objects being one of said plurality of attribute data objects, a being-held relationship existing between each attribute data object and its holder attribute data object, and each of said attribute data objects having a being-held relationship with only a single other attribute data object, thereby establishing a hierarchy of said plurality of attribute data objects;
 - a referent attribute data object for at least one of said attribute data objects, said referent attribute data object being nonhierarchically related to a holder attribute data object for the same at least one of said attribute data objects and also being one of said plurality of attribute data objects, attribute data objects for which there exist only holder attribute data objects being called element data objects, and attribute data objects for which there also exist referent attribute data objects being called relation data objects; and
 - an apex data object stored in said memory and having no being-held relationship with any of said attribute data objects, however, at least one of said attribute data objects having a being-held relationship with said apex data object.

Claims 6 through 19 claim a data processing

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system executing an application program, *1582 containing a database, a central processing unit (CPU) means for processing the application program, and a memory means for holding the claimed data structure. Claims 20-23, 25, and 28 specify methods of accessing, creating, adding, and erasing ADOs within the data structure. Claim 24 specifies a method for creating a data structure. Claims 26, 27, and 29 claim methods of creating and erasing non-hierarchical relationships between ADOs and referent ADOs.

THE PROCEEDINGS BEFORE THE PATENT AND TRADEMARK OFFICE

The examiner rejected claims 1 through 5 under 35 U.S.C. § 101 as non-statutory subject matter. The examiner also rejected claims 1 through 19 under 35 U.S.C. § 103 as obvious in light of U.S. Patent No. 4,774,661 (Kumpati). Finally, the examiner rejected claims 20 through 29 under 35 U.S.C. § 102(e) as anticipated by Kumpati.

The Board reversed the 35 U.S.C. § 101 rejection. The Board found that claims 1 through 5, directed to a memory containing stored information, as a whole, recited an article of manufacture. The Board concluded that the invention claimed in claims 1 through 5 was statutory subject matter.

When evaluating patentability under sections 102 and 103, the Board failed to give patentable weight to the claimed data structure. The Board stated that the claims on appeal specify relationships between the ADOs stored in the memory. The Board analogized Lowry's data structure comprised of ADOs to printed matter and relied on this statement from *In re Gulack*, 703 F.2d 1381, 217 USPQ 401 (Fed.Cir.1983):

Where the printed matter is not functionally related to the substrate, the printed matter will not distinguish the invention from the prior art in terms of patentability. Although the printed matter must be considered, in that situation it may not be entitled to patentable weight.

Id. 703 F.2d at 1385.

In *Gulack*, this court concluded that "the critical question is whether there exists any new and

unobvious functional relationship between the printed matter and the substrate." *Id.* at 1386 (footnote omitted). The Board therefore framed the question as whether a new, nonobvious functional relationship exists between the printed matter (data structure with ADOs) and the substrate (memory). The Board determined that Lowry did not show such a functional relationship. Thus, the Board agreed with the examiner that the data structure could not distinguish the claimed invention from the prior art. The Board held that Kumpati, disclosing a CPU using a memory and containing stored data in a data structure, rendered all claims either anticipated or obvious. Lowry appealed.

DISCUSSION

[1][2] This court reviews the Board's determination of obviousness *de novo*. *In re Woodruff*, 919 F.2d 1575, 1577, 16 USPQ2d 1934, 1935 (Fed.Cir.1990). This court reviews factual findings underlying the obviousness determination for clear error. *Id.* Whether a prior art reference anticipates the claimed invention is a question of fact reviewed under the clearly erroneous standard. *In re King*, 801 F.2d 1324, 1326, 231 USPQ 136, 138 (Fed.Cir.1986).

[3] The Patent and Trademark Office (PTO) must consider all claim limitations when determining patentability of an invention over the prior art. *Gulack*, 703 F.2d at 1385. The PTO may not disregard claim limitations comprised of printed matter. *See Gulack*, 703 F.2d at 1384; *see also Diamond v. Diehr*, 450 U.S. 175, 191, 101 S.Ct. 1048, 1059, 67 L.Ed.2d 155 (1981). This court in *Gulack*, however, would not give patentable weight to printed matter absent a new and unobvious functional relationship between the printed matter and the substrate. The Board in this case determined that Lowry's data structures were analogous to printed matter and therefore the specific features of the constituent ADOs deserved no patentable weight without a functional printed matter-substrate relationship. Finding no such functional relationship between the ADOs *1583 and the memory, the Board refused to consider the specific data structure limitations.

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As an initial matter, this court notes that *Gulack* cautioned against a liberal use of "printed matter rejections" under section 103:

A "printed matter rejection" under § 103 stands on questionable legal and logical footing. Standing alone, the description of an element of the invention as printed matter tells nothing about the differences between the invention and the prior art or about whether that invention was suggested by the prior art.... [The Court of Customs and Patent Appeals], notably weary of reiterating this point, clearly stated that printed matter may well constitute structural limitations upon which patentability can be predicated.

Gulack, 703 F.2d at 1385 n. 8. Despite this cautioning, the Board erroneously extended a printed matter rejection under sections 102 and 103 to a new field in this case, which involves information stored in a memory. This case, moreover, is distinguishable from the printed matter cases. The printed matter cases "dealt with claims defining as the invention certain novel arrangements of printed lines or characters, useful and intelligible only to the human mind." *In re Bernhart*, 417 F.2d 1395, 1399, 163 USPQ 611, 615 (CCPA 1969).

The printed matter cases have no factual relevance where "the invention as defined by the claims requires that the information be processed not by the mind but by a machine, the computer." *Id.* (emphasis in original). Lowry's data structures, which according to Lowry greatly facilitate data management by data processing systems, are processed by a machine. Indeed, they are not accessible other than through sophisticated software systems. The printed matter cases have no factual relevance here.

[4] Nor are the data structures analogous to printed matter. Lowry's ADOs do not represent merely underlying data in a database. ADOs contain both information used by application programs and information regarding their physical interrelationships within a memory. Lowry's claims dictate how application programs manage information. Thus, Lowry's claims define functional characteristics of the memory.

Contrary to the PTO's assertion, Lowry does not

claim merely the information content of a memory. Lowry's data structures, while including data resident in a database, depend only functionally on information content. While the information content affects the exact sequence of bits stored in accordance with Lowry's data structures, the claims require specific electronic structural elements which impart a physical organization on the information stored in memory. Lowry's invention manages information. As Lowry notes, the data structures provide increased computing efficiency.

Indeed, Lowry does not seek to patent the Attributive data model in the abstract. Nor does he seek to patent the content of information resident in a database. Rather, Lowry's data structures impose a physical organization on the data.

In Lowry's invention, the stored data adopt no physical "structure" per se. Rather, the stored data exist as a collection of bits having information about relationships between the ADOs. Yet this is the essence of electronic structure. In *Bernhart*, this court's predecessor noted:

There is one further rationale used by both the board and the examiner, namely, that the provision of new signals to be stored by the computer does not make it a new machine, i.e. it is *structurally* the same, no matter how new, useful and unobvious the result.... To this question we say that if a machine is programmed in a certain new and unobvious way, it is physically different from the machine without that program; its memory elements are differently arranged. The fact that these physical changes are invisible to the eye should not tempt us to conclude that the machine has not been changed.

Bernhart, 417 F.2d at 1400 (emphasis added).

More than mere abstraction, the data structures are specific electrical or magnetic *1584 structural elements in a memory. According to Lowry, the data structures provide tangible benefits: data stored in accordance with the claimed data structures are more easily accessed, stored, and erased. Lowry further notes that, unlike prior art data structures, Lowry's data structures simultaneously represent complex data accurately

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and enable powerful nested operations. In short, Lowry's data structures are physical entities that provide increased efficiency in computer operation. They are not analogous to printed matter. The Board is not at liberty to ignore such limitations.

[5] Even assuming, arguendo, that data objects and data structures are analogous to printed matter, the Board erred in its reliance on *Gulack*. As part of its burden to establish a *prima facie* case of obviousness, see *In re Oetiker*, 977 F.2d 1443, 1445, 24 USPQ2d 1443, 1444 (Fed.Cir.1992), the burden of establishing the absence of a novel, nonobvious functional relationship rests with the PTO. "If examination at the initial stage does not produce a *prima facie* case of unpatentability, then without more the applicant is entitled to grant of the patent." *Id.* The PTO did not establish that the ADOs, within the context of the entire claims, lack a new and nonobvious functional relationship with the memory. The ADOs follow a particular sequence that enables more efficient data processing operations on stored data. The ADOs facilitate addition, deletion, and modification of information stored in the memory. In sum, the ADOs perform a function. *Gulack* requires no more. See *Gulack*, 703 F.2d at 1386.

[6] With the foregoing in mind, this court now turns to the specific prior art rejections. The Board rejected claims 1 through 19 under section 103 as obvious over Kumpati. The Board found that claims 20-29 were anticipated by Kumpati. Claims 1 through 19 include a memory, comprising the claimed data structure, for storing data for access by an application program. Claims 20 through 29 describe methods of performing data management operations with respect to the claimed data structure.

The Kumpati patent, entitled "Database Management System with Active Data Dictionary," discloses a database management system containing an active data dictionary that the user can access and modify. Kumpati's data dictionary contains information about the structure and usage of the data stored in the database management system.

Kumpati discloses a data model within a database

management system complete with hierarchical and relational interrelationships. Kumpati further defines an "attribute" as a "function that maps an entity set or relationship set into one or more value sets." A value set, in turn, "further identifies (or defines) the entity by populating these attributes with specific items of data which define these characteristics."

Kumpati does not, however, disclose Lowry's ADOs and their specific hierarchical and non-hierarchical relationships. More specifically, Kumpati does not disclose the claimed pyramidal arrangement of hierarchically arranged ADOs, complete with apex ADO. Kumpati's relationship sets are different from Lowry's relation data objects, having non-hierarchical relationships with other ADOs. Neither are Kumpati's "attributes," performing a mapping function, equivalent to Lowry's ADOs, containing information used by the application program as well as information regarding its interrelationships with other ADOs.

Lowry's claimed invention involves an organization of information and its interrelationships which Kumpati neither discloses nor suggests. Kumpati also does not render Lowry's claims obvious. The Board erred in holding otherwise. Claims 1 through 19 are, as a whole, not obvious in light of Kumpati.

Because Kumpati does not contain all limitations of claims 20 through 29, the Board erred in holding these claims anticipated by Kumpati. Therefore, this court reverses the section 102 rejection of claims 20 through 29.

CONCLUSION

The Board erred by denying patentable weight to Lowry's data structure limitations. *1585 This court reverses the Board's determination that claims 1 through 19 are obvious. This court also reverses the Board's decision that claims 20 through 29 are anticipated under section 102.

REVERSED.

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